Table 1: Features that Distinguish Present Invention from Prior Art

	Uses Abrasives [1]		Uses Non-Abrasive Media [2]			Mechanism of Stock Removal on Hardened Workpieces [3]		Ultimate Surface Finish [4]			
Prior Art	Media is non-abrasive, but loose abrasives are added.	Media contains hard abrasive particles.	**Ceramic** Hard material made from **metal oxides** having a high density.	**Plastic** Soft having a low density.	**Metal** These are soft metal alloys **(not metal oxides)** having a high density.	**Mechanical** Abrasive particles act like miniature cutting tools, which shear off metal. The chemicals used do **not** react with the basis metal.	**Chemical / Mechanical** Chemical reacts with surface of metal to create a coating softer than the basis metal. Media only removes the soft coating.	**Appearance**	**R_a >3.0 µin.** Highly Textured	**R_a < 2.5 µin.** Micro-textured	**R_a < 2.5 µin.** Slight Micro-texture
'500 (REM)		**X**					**X** **High stock removal rate**	**Hazy [4c]**	**X**		
'333 (REM) (Col. 4, lines 42-44)			**X**				**X** **High stock removal rate**	**Specular & Ripple Free**		**X**	
'333 (REM) (Col. 6, lines 21-34)					**X**		**X**	**Rippled**	**NA**	**NA**	**NA**
'544 (Balz) (Col. 7, lines 20-25)					**X**	**X** **Insignificant stock removal**		**Good Color**	**NA**	**NA**	**NA**
'466 (Petrone) (Col. 2, lines11-22)		**X**				**X** **Low stock removal rate**		**Hazy [4c]**	**X [4c]**		
'466 (Petrone) (Col. 3, lines 39-54)	**X**			**X**		**X** **Low stock removal rate**		**Hazy [4c]**	**X [4c]**		
'466 (Petrone) (Col. 5, line 5)				**X** **i.e., 0% abrasive**		**X** **No stock removal**			**NA**	**NA**	**NA**
Present Invention				**X**			**X** **High stock removal rate**	**Specular & Ripple Free**			**X**
Present Invention					**X**		**X** **High stock removal rate**	**Specular**			**X**

Footnotes:

1. There are two types of manmade medias commercially available:

a. *Abrasive.* These can be made from plastics or ceramics and have abrasive particles having high hardness distributed throughout. These particles protrude from the surface and act as mini-cutting tools to remove metal stock from the workpiece. Such media are designed to wear so that fresh abrasive particles are available to effect stock removal. Since abrasive media removes stock by shearing off small particles of metal, the finished surface is highly textured and non-reflective. As the hardness of the workpiece is increased, the rate of stock removal dramatically decreases.

b. *Non-abrasive.* These do not contain hard abrasive particles, and are designed to have a low wear rate so that their size and shape are retained for long durations. If the starting surface of a workpiece is mirror-bright, these media would only cause a very slight micro-texturing of the surface such that the finished workpiece would still be mirror-bright. On their own, these media cannot remove a measurable amount of stock especially on hardened workpieces in a practical amount of time. However, if loose abrasive grit is used in conjunction with the non-abrasive media, it will behave similarly to the abrasive media described above.

2. There are three types of manmade media pertinent to this patent application

a. Ceramic. Ceramics are crystalline compounds of metallic and nonmetallic elements. Examples of common ceramics are cement, bricks, porcelain, and dinnerware. The metals mentioned in the patent literature used in ceramic media are present as oxides of the metals.

b. Plastic. These are much softer materials than ceramic and are often manufactured from polyester resins.

c. Metals. These can be either the pure metallic elements, or a combination of two or more elements. Examples are carbon steels used in gears and stainless steels used for tableware.

3. *Mechanism of Stock Removal of Hardened Workpieces:*

a. *Mechanical.* As discussed in Footnote 1, it becomes progressively more difficult to machine or cut metals as the hardness increases. For example, the mechanical removal of stock using abrasive media or non-abrasive media mixed with loose abrasives having hardness greater than 58 HRC, occurs at a very low rate.

b. *Chemical/Mechanical.* The active chemistry reacts with the metal surface of the workpiece creating a thin coating which is softer than the basis metal. The media removes this softened layer, which re-forms, and the process repeats itself. Therefore, no abrasives are needed, and less mechanical energy is needed to remove stock. Whereas the '333 patent taught that steel media produced an inferior (i.e., a rippled surface), and furthermore taught that extremely hard, high density (>2.75 g/cc) non-abrasive ceramic media was essential for producing the optimum surface and refinement rate, the present invention discovered that stainless steel media (much softer and much denser than ceramic) or non-abrasive plastic media (much softer and less dense than ceramic) could produce an even more desirable surface. In point of fact, no one practiced in the art has successfully used chemical/mechanical finishing with non-abrasive plastic media or stainless steel media even though the REM '333 patent was issued in 1989. Therefore, since no one practiced in the art accomplished this prior to the present invention, it must be non-obvious.

4. *Ultimate Surface Finish:*

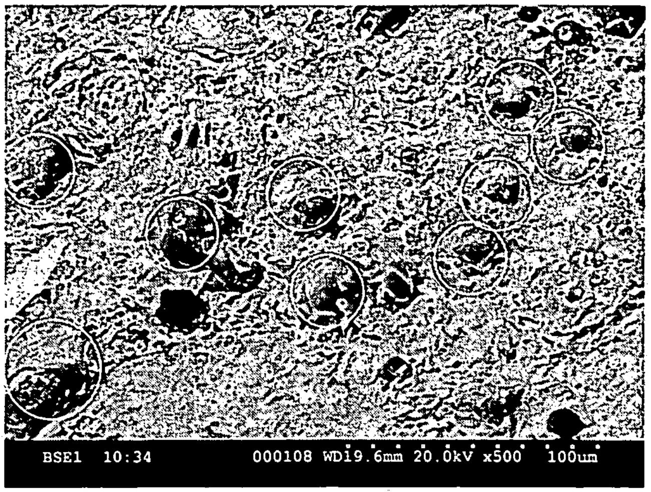
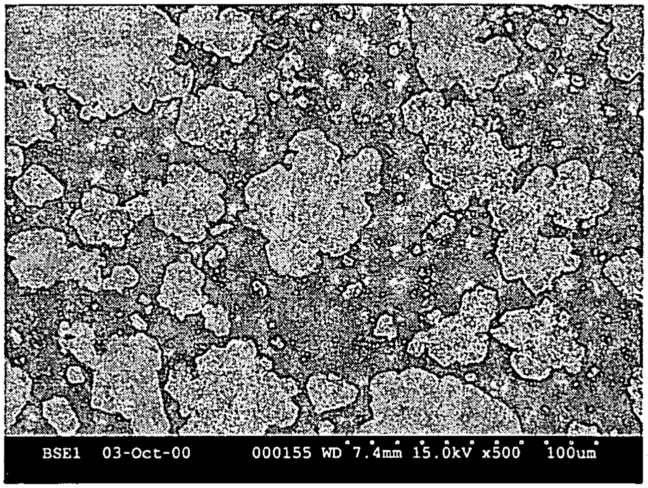
a. A specular surface is one having a mirror-like appearance producing a very clear reflection.

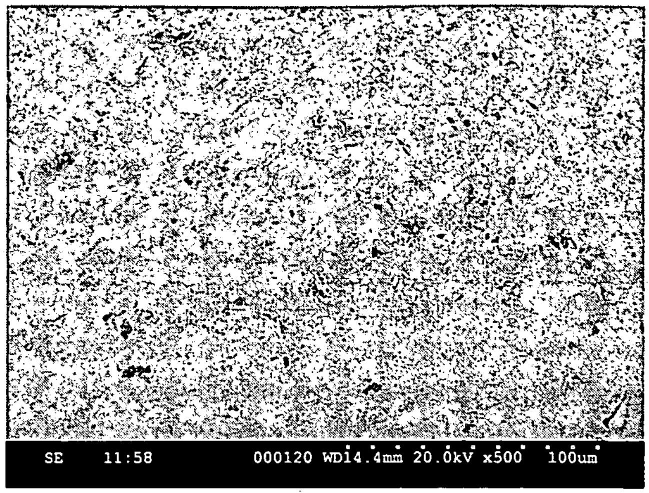
b. R_a (or Arithmetic Mean Roughness) is defined and measured in accordance with ISO standard 4287, which is the same as DIN standard 4768.

c. Known to one practiced in the art.

d. Micro-Texture: Small scratches on surface which can be readily seen under magnification. This is clearly illustrated in Figure 1 of the patent application.

e. NA: Not Available. '544 (Balz) Patent does not disclose any quantitative measurement of final surface roughness.

Abrasive Media Abrasive media contains extremely hard abrasive particles (e.g., fused alumina) protruding from the surface. Some of the larger abrasive particles are circled. The abrasives remove stock by a cutting action. Magnification: 500 X	
Non-Abrasive Media The white plateaus are calcined alumina, and are much softer than the abrasive particles shown in the above figure. This media cannot remove a significant amount of stock through a cutting action.Magnification: 500X	

Steel Media Again, this media is non-abrasive since it contains no abrasive particles and can be softer than the workpiece. On its own, it cannot remove any significant amount of stock. Magnification: 500X	

As can be seen, the prior art, and no combination of the prior art, gave the combination that is currently being claimed. No non-abrasive media has been capable of superfinishing the surface of a metal article (i.e. finishing the metal article to a Ra < 2.5 μin. with little micro-texture) until the implementation of the present invention.

It is believed that no fee is due; however, should any fees be required for any reason relating to the enclosed materials, the Commissioner is authorized to deduct said fees from Deposit Account No. 01-2508/12350.0008.CNUS01.

Respectfully submitted,

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